MASSEY-FERGUSON

EXTERNAL AUXILIARY HYDRAULIC CONTROL VALVE

Massey-Ferguson Inc.
DETROIT, MICHIGAN

FORM NO. 690 375 M1

Index

	Page
Valve Functions	2
Valve External Nomenclature	2
Valve Body	2
Valve Body Side Cover Assembly	2
Valve Body Switch Valves	2
Valve Body By-pass Valve	2
Valve Body External Cylinder Ports	2
Valve Spool Handles	2
Valve Body to Tractor Pressure Ports	3
Auxiliary "Third" Spool Valve	3
Valve Operations	4
Valve Adjustments	4
Switch Valve Settings	4
Simultaneous External Cylinder Action Adjustment	4
Valve Handle Detent Release Pressure Adjustment	4
By-Pass Valve Adjustment	4
Valve Pre-Operation Information	5
Valve Installation	5
Cylinder Connections to the Valve	5
Connecting Single Acting Cylinders	5
Connecting Single Acting Cylinders for "Float" Applications	6
Connecting Double Acting Cylinders	6
Connecting Single and Double Acting Cylinders	7
Valve Body Internal Nomenclature	7
Valve Internal Pressure and Sump Ports	7
Main Valve Spools	7
Shuttle Spool Valves	7
Check Valves	8
Main Valve Spool Regulator	8
Valve Operating Information	8
Valve Neutral Oil Flow Circuit	8
Tractor Internal Draft Control with Valve Attached Oil Flow Circuit	9
Single Acting Cylinder Oil Flow Circuit	9
Single Acting Cylinder "Float" Position Oil Flow Circuit	10
Double Acting Cylinder Oil Flow Circuit	11
Single and Double Acting Cylinder Neutral Position Oil Flow Circuit	12
Single and Double Acting Cylinder Raise Oil Flow Circuit	12
Single and Double Acting Cylinder Lower Oil Flow Circuit	12
Single Acting Cylinder Lower-Double Acting Cylinder Raise Oil Flow Circuit	13
Single Acting Cylinder Raise-Double Acting Cylinder Lower Oil Flow Circuit	14
MF 85 Tractor Draft Control and Valve Control Applications	14
Selective and Delayed Lift Cylinder Applications	14
Auxiliary Valve Operations Chart	15
Tractor Accessory Remote Cylinder Kits	15

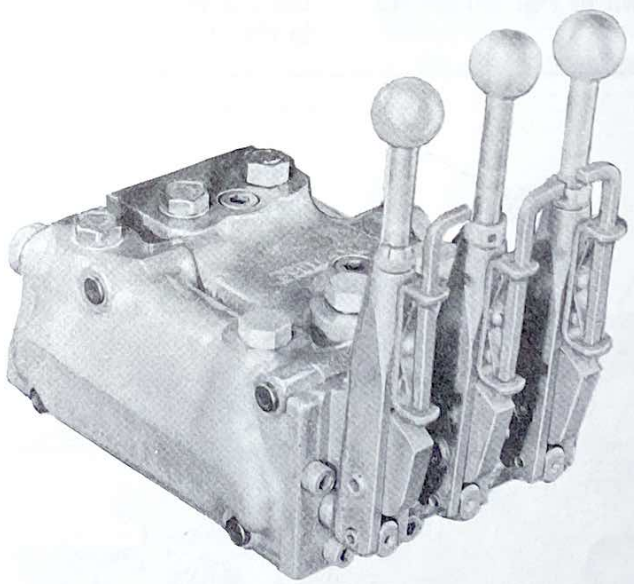
The Massey-Ferguson External Auxiliary Control Valve

The Massey-Ferguson "Two Spool" Auxiliary External Control Valve was designed for the customer who desires to operate and control single and double acting external hydraulic cylinders in conjunction with all models of the TO 35, MF 50, MF 65, MF 202, and MF 85 Tractors.

This new auxiliary control valve with open center control permits you, as a Massey-Ferguson Tractor owner, to operate and control not only pull behind agricultural implements and light industrial machinery hydraulic cylinders, but also to operate the tractor internal hydraulic system simultaneously without hindering the function of either operation.

Installation of the valve on any of the aforementioned tractor models, presents a small compact unit within convenient reach of the operator. Outlets are provided on the tractor hydraulic lift cover below the seat to accommodate the control valve so that external hydraulic cylinders can be operated by oil pressure from the tractor internal hydraulic pump.

The new "Deluxe" auxiliary valve, when installed on the tractor, provides for an unsurpassed quantity of single acting, double acting, and multiple single and double acting external hydraulic cylinder applications.



Massey-Ferguson Inc.

VALVE FUNCTIONS

The new "Deluxe" external auxiliary control valve has been designed, developed, and constructed to permit operation of the following tractor internal hydraulic and external cylinder systems.

1. Tractor internal lower link lift cylinder.
2. Single acting external cylinders.
3. Double acting external cylinders.
4. Combination single and double acting external cylinder applications.
5. Selective lift external cylinder applications.
6. Delayed lift external cylinder applications.
7. Simultaneous lift external cylinder applications.

VALVE EXTERNAL NOMENCLATURE

In order for the installed external auxiliary control valve to function as desired to operate external hydraulic cylinders and the tractor internal hydraulic system, the operator must become familiar with the component parts of the valve and their functions.

VALVE BODY

The valve body, as illustrated in Fig. 1 is a Meehanite Steel casting with machined passages to accept the valve component parts and cast passages to direct the flow of oil within the body.

VALVE SIDE COVER ASSEMBLY

The side cover assembly, a basic component part of the two spool valve as shown in Fig. 1, contains cast passages for oil flow.

When it is desired to convert the "two spool" valve to a "three spool" valve, the side cover can easily be removed and the single spool valve attached.

VALVE BODY SWITCH VALVES

The switch valves, located in the rear of the valve body, as illustrated in Fig. 1 may be adjusted by the operator to control each individual valve spool to operate either single or double acting external cylinders.

VALVE BODY BY-PASS VALVE

Located on the left side of the valve body, as shown in Fig. 1, this by-pass valve has been incorporated into the valve body for future external cylinder applications.

VALVE EXTERNAL CYLINDER PORTS

The auxiliary valve is designed to permit oil to be pumped through the valve to an external cylinder when the valve spool handle is placed in the detent lift position. Therefore, the rear ports in the valve body, as shown in Fig. 1, should be used when connecting single acting external cylinders.

VALVE SPOOL HANDLES

The handles, as shown in Fig. 1, are attached directly to the valve spools and may be placed in the lowering, raising or neutral position, as shown in Fig. 2.

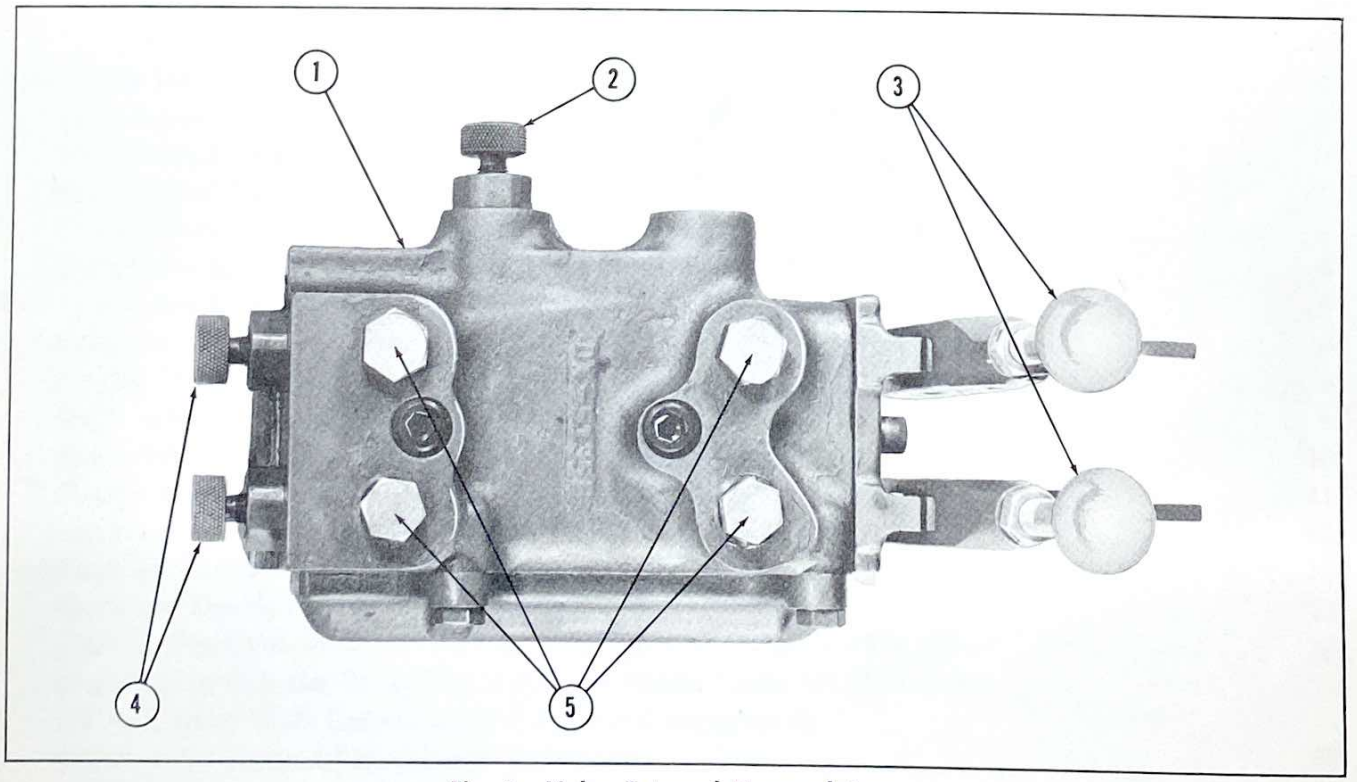


Fig. 1 Valve External Nomenclature

1. Valve body
2. By-pass valve
3. Valve spool handles
4. Switch valves
5. External pressure ports

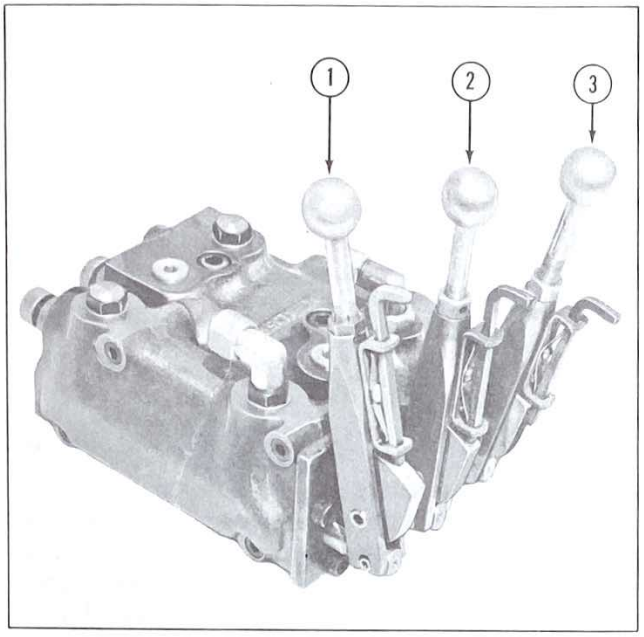


Fig. 2 Valve Spool Handle Positions
1. Detent raise 2. Neutral 3. Detent lower

VALVE BODY TO TRACTOR PRESSURE PORTS

The valve body external pressure ports connecting the valve to the hydraulic pump and the tractor internal lift cylinder as shown in Fig. 3, are machined for "O" ring seals to prevent oil leakage and, consequently, a loss of oil pressure.

AUXILIARY "THIRD" SPOOL VALVE

There is available from your Massey-Ferguson Dealer a single valve spool as shown in Figure 4, which can easily be attached to your "Two Spool" valve. The addition of the third spool will enable you to operate an additional external cylinder when desired.

To install the "Single Spool" valve to the "Two Spool" valve:

1. Remove the four Allen head cap screws securing the side cover assembly to the "Two Spool" valve body and remove the side plate.

NOTE: Use extreme care when removing the side cover assembly so as not to damage the sealing "O" Rings.

2. Install the "Single Spool Valve" to the two spool valve and secure with the cap screws.

NOTE: Carefully store the removed side cover assembly to prevent damage to the machined surface. If this surface, particularily around the orifices, is scored or scratched, the valve will not seat properly on the tractor lift cover. Consequently a loss of oil pressure will result.

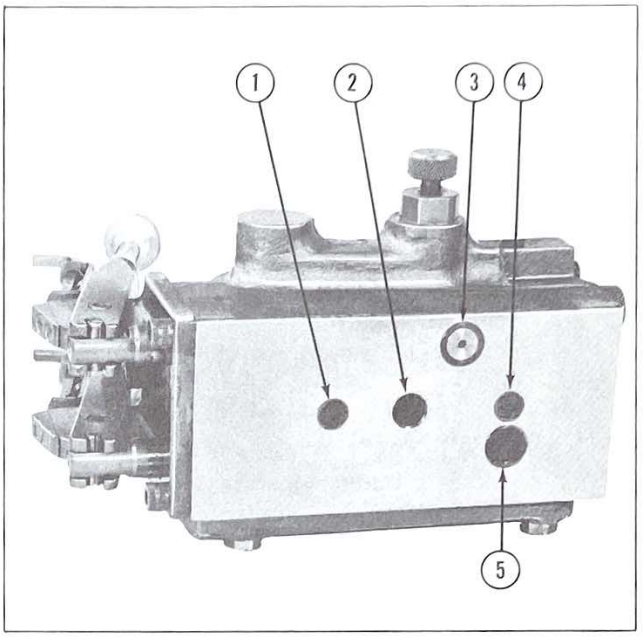


Fig. 3 Valve Body Pressure Ports
1. Valve to Tractor Attachment Hole
2. Valve to Tractor Hydraulic Pump Port
3. Valve to Tractor Internal Lift Cylinder Port
4. Valve to Tractor Attachment Hole
5. Valve to Tractor Sump Port

The addition of the "Single Spool Valve" to the Two Spool Valve does not alter the functioning of the valve. It will be noted in the Valve Operations section of the manual that the operation of the "Single" spool is typical to that of the valve spools in the Two Spool Valve.

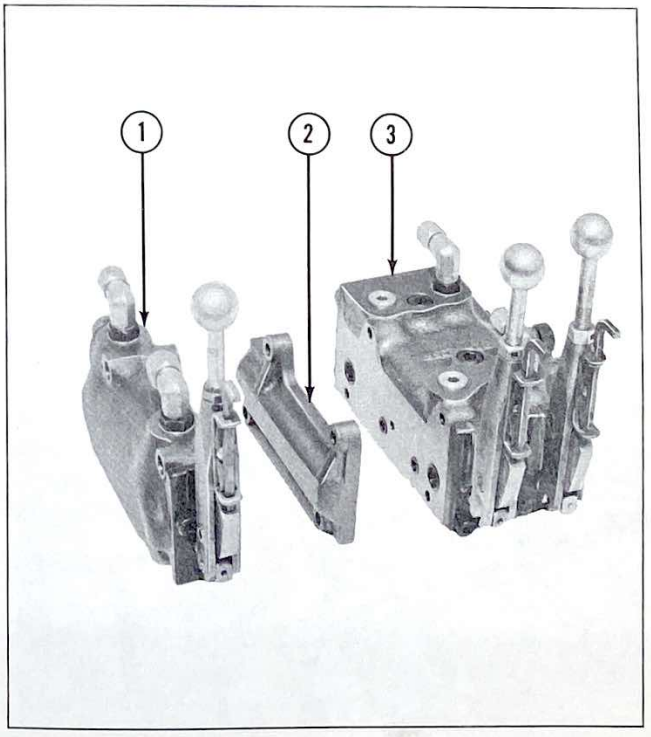


Fig. 4 Single Spool Valve Assembly
1. Single spool valve assembly 3. Two spool valve assembly
2. Side cover assembly

Valve Operation

The new Massey-Ferguson "two or three spool" auxiliary external control valve has been designed, developed and constructed to fulfill the requirements created by the ever growing use of external cylinders in the field of agricultural and light industrial machinery operations.

The multiple external cylinder applications of the auxiliary valve, its simplicity of installation to the tractor and ease of connection to the cylinders makes the auxiliary valve one of the most widely used tractor accessories in the Massey-Ferguson line of equipment.

VALVE ADJUSTMENTS

Prior to attempting to operate either single or double acting external cylinders, the following switch and by-pass valve settings must be made for correct auxiliary valve functioning.

SWITCH VALVE SETTINGS

In order to control single acting external cylinders, the auxiliary valve switch valve must be set in the "out" position as shown in Fig. 5. This can be accomplished by turning the valve knob counterclockwise to the fully "out" position.

To control double acting external cylinders, the auxiliary valve switch valve must be set in the "in" position, as shown in Fig. 5. This is accomplished by turning the valve knob clockwise to the fully "in" position.

NOTE: Refer to Valve Operational Chart on page 15 for the correct switch valve setting for the application desired.

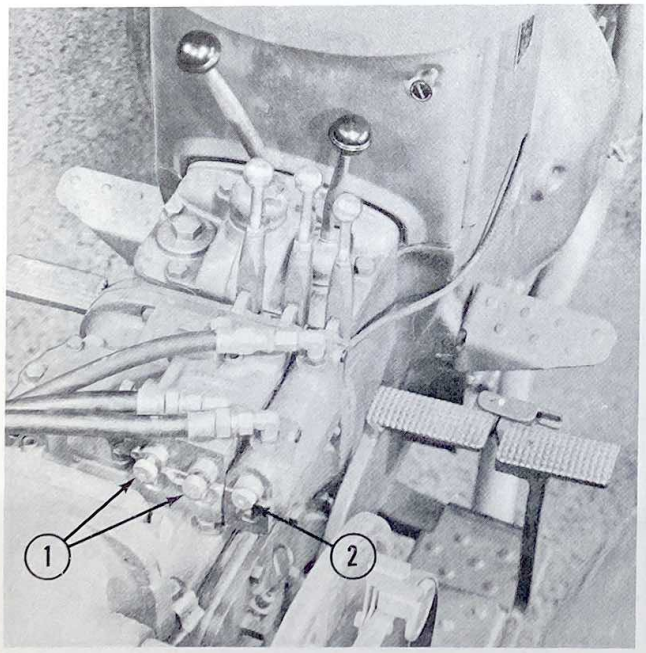


Fig. 5 Switch Valve Setting
1. Single acting cylinder switch valve setting
2. Double acting cylinder switch valve setting

Simultaneous External Cylinder Action Adjustment

In cases where simultaneous lowering of two or more single acting cylinders of unequal loading pressure is desired, the switch valve on the last valve spool used may be "throttled" by one or two turns to provide sufficient back pressure at the shuttle spools to unseat the lock valves simultaneously.

Throttling of the oil flow with the switch valve is also useful in cases where only a slight pressure is desired on the downward stroke of double acting cylinder applications, for example dozer blade applications.

VALVE HANDLE DETENT RELEASE PRESSURE ADJUSTMENT

The automatic detent release pressure on the valve handle is pre-set to release from the lift position at 1500 PSI automatically. If the handle releases prematurely from the lift position or stays "engaged" after the external cylinder reaches the maximum lift position, the valve handle detent may be adjusted to compensate for the increase or decrease in the lift load.

By loosening the "jam nut" on the handle stem and turning the stem clockwise the pressure required to return the valve spool to neutral will increase and by turning the stem counterclockwise the detent pressure decreases. Be certain to secure the "jam nut" once this adjustment has been made.

The handle detent pressure may be completely released for applications not requiring automatic spool valve return to neutral. This is accomplished by turning the valve stem "out" far enough so that the detent is not engaged.

BY-PASS VALVE ADJUSTMENT

The by-pass valve has been incorporated into the valve body for future external cylinder applications. The by-pass valve setting for all applications discussed in this manual is the "closed position". The valve "closed" position is obtained by turning the knob clockwise to the fully "in" position.

VALVE PRE-OPERATING INFORMATION

This section of the manual is devoted to the auxiliary valve installation to the tractor, its connection to external cylinders, and minor adjustments of the valve prior to use.

VALVE INSTALLATION

To install the double or triple spool external valve to the tractor:

1. If the valve is new, remove the masonite cover secured to the bottom of the valve.
2. Lower the lower links to their lowest position by moving the hydralever forward to the bottom of the quadrant.
3. Clean the area around the tractor hydraulic lift cover transfer plate and remove the two attaching cap screws.
4. Remove the transfer cover and standpipe from the lift cover, as shown in Fig. 6.
5. Remove the standpipe from the seat in the cover.

NOTE: Use care when removing the standpipe from the transfer cover to prevent damaging the sealing "O" ring.

6. Clean the underside of the auxiliary valve, check the sealing "O" rings and insert the standpipe into position in the valve.
7. Carefully insert the standpipe through the port in the tractor lift cover and center the lower end of the pipe in the tapered hole in the top of the hydraulic pump body.
8. Attach the auxiliary valve to the tractor lift cover with the two Allen head screws and tighten securely as shown in Fig. 7.

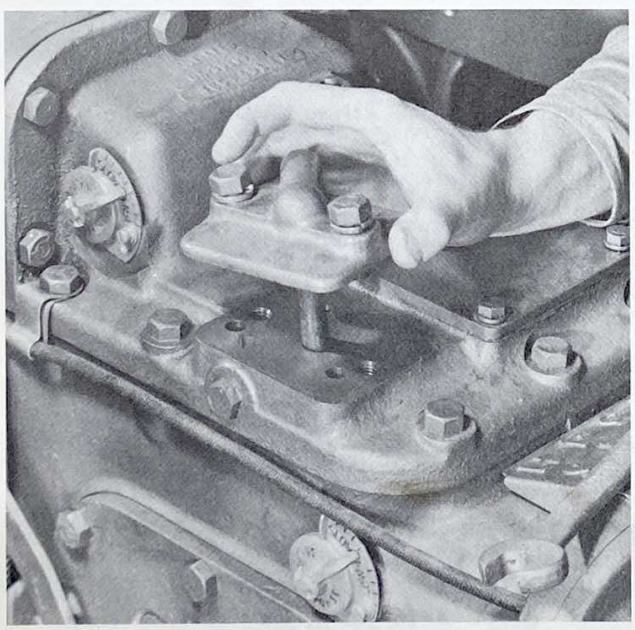


Fig. 6 Removing Tractor Hydraulic Lift Cover Transfer Plate

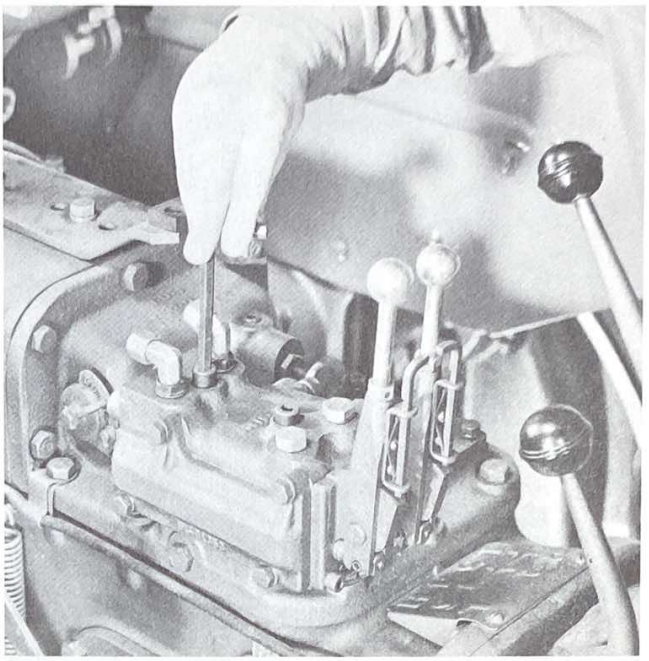


Fig. 7 Installing Valve to Tractor Hydraulic Lift Cover

NOTE: Carefully store the removed transfer cover to prevent damage.

CYLINDER CONNECTION TO VALVE

The auxiliary valve is designed to permit oil to be pumped through the valve to an external cylinder when the spool valve handle is placed in the back position and permits oil to return to the tractor sump in the forward position; therefore, when connecting cylinder hoses to the auxiliary valve always connect the lift side of the cylinder to the rear ports where the lock valves have been incorporated. The valve ports are machined to receive standard SAE 3/8 inch (tube) straight thread "O" ring elbow type fittings.

The Number 1 valve spool of the auxiliary valve, used on TO 35, MF 50, MF 202, and MF 65 model tractors, is used primarily to direct the oil flow to actuate the tractor internal cylinder for open center single acting applications. The No. 1 spool valve is connected internally to the tractor internal lift cylinder in parallel; therefore, the No. 1 spool valve should not be used for single or double acting external cylinders unless the tractor lower links are fixed by stays or are supported in the raised position.

CONNECTING SINGLE ACTING CYLINDERS

Connect single acting cylinder hoses to rear port of valve No. 2 when using the "double spool" valve and the rear port of valve No. 3 when using the "triple spool" valve, as shown in Fig. 8.

NOTE: If valve No. 1 is to be used for an external single acting cylinder, connect it to the rear port of the valve and fix the tractor

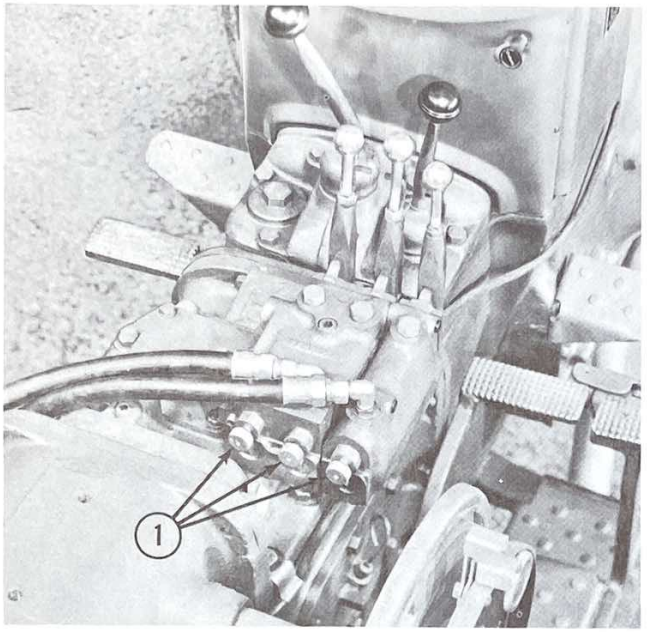


Fig. 8 Single Acting Cylinders Connected to the Valve
1. Switch valves "out"

lower links on the TO 35, MF 50, MF 202, and MF 65 model tractors, as shown in Fig. 9. On the MF 85 model tractor the manual shut-off valve located between the hydraulic lift cover cross bore in the front cover and the passage leading to the lift cylinder as shown in Fig. 10, must be closed or "turned in" if the tractor lower links are to be positioned below the full transport position. The valve ports not being used should be plugged. Refer to the Valve Operational chart on page 15 for the correct switch and by-pass valve settings to use when single acting cylinder application is desired.

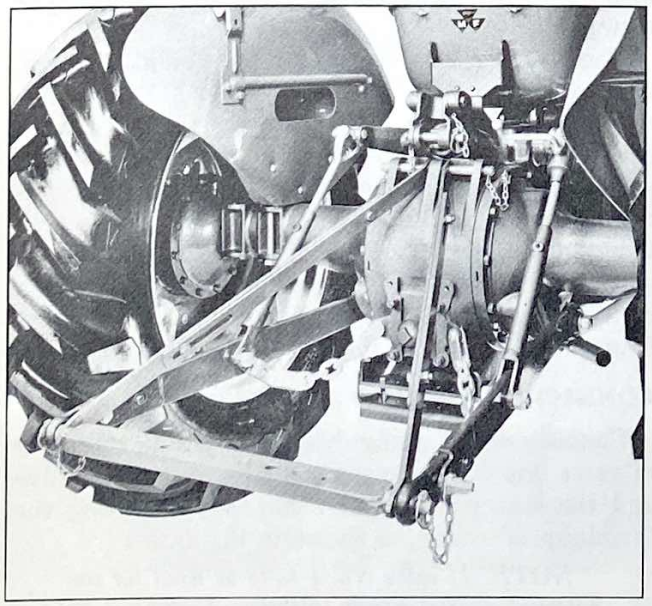


Fig. 9 MF 65 Tractor Lower Links in Fixed Position

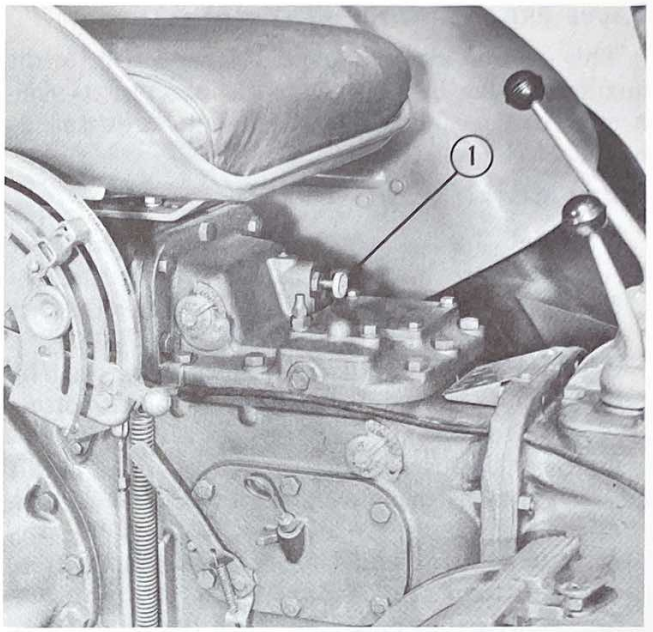


Fig. 10 MF 85 Tractor Hydraulic Lift Cover Shut-off Valve
1. Hydraulic lift shut-off valve

Connecting Single Acting Cylinders for "Float" Position

The valve spool handles must be placed in the lowering latched position when single acting cylinder "float" applications are desired. With the valve handles latched in the lowering position, the cylinder is free to "float" or move in either direction since the oil flow within the cylinder is not locked.

NOTE: It is not possible to raise an implement when another valve is in the "float" position. Return all valves to the neutral position before attempting to raise an implement.

Connecting Double Acting Cylinders

Connect double acting cylinder hoses to the front and rear ports of valve No. 2 when using the "double spool" valve and the front and rear ports of valve No. 3 when using the "triple spool" valve, as shown in Fig. 11. Plug both the front and rear ports of valve No. 1.

NOTE: If valve No. 1 is to be used for an external double acting cylinder, connect the cylinder to the front and rear ports and fix the tractor lower links on the TO 35, MF 50, MF 202, and MF 65 model tractors. On the MF 85 tractor the manual shut-off valve located between the hydraulic lift cover cross bore and the passage to the lift cylinder must be "closed" or turned in when the lower links are to be positioned below the full transport position. Refer to the Valve Operations chart

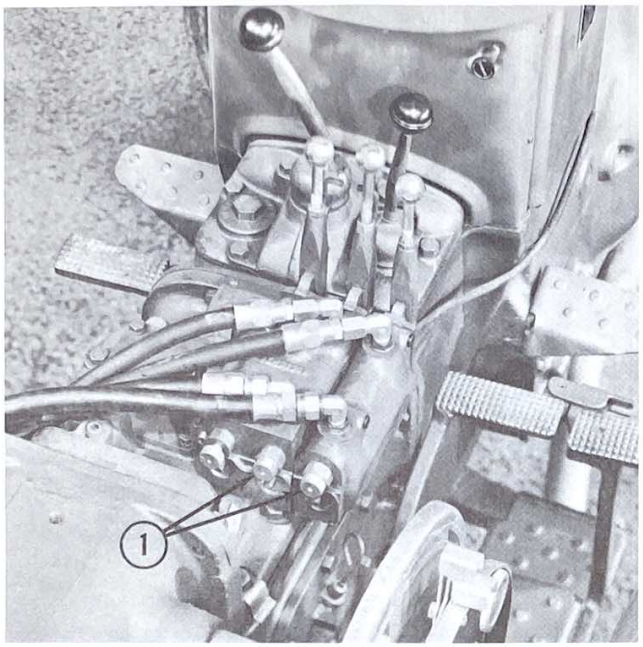


Fig. 11 Double Acting Cylinders Connected to the Valve
1. Switch valves "in"

on page 15 for the correct switch and by-pass valve settings to use for double acting external cylinder application.

Connecting Single and Double Acting Cylinders

For proper auxiliary valve functioning, when operating both single and double acting cylinders simultaneously, it is of the utmost importance that the double acting cylinder be connected to the valve

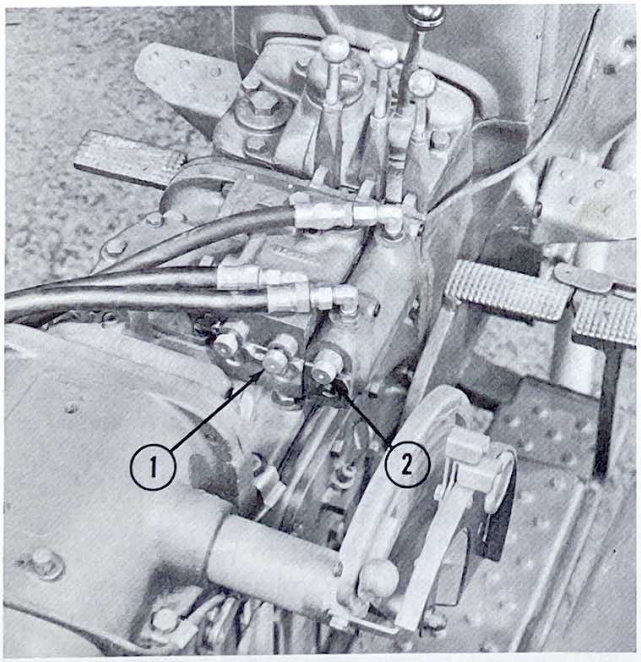


Fig. 12 Single and Double Acting Cylinders Connected to the Valve
1. Switch valve "out" 2. Switch valve "in"

to the right of the ones used for single acting cylinders.

First, connect the single acting cylinder to the rear port of valve No. 2 and plug the front port. Connect the double acting cylinder to the front and rear ports of valve No. 3 when using the "triple spool" valve as shown in Fig. 12. If the No. 1 valve is not used, plug both front and rear ports.

When connecting a single acting cylinder to valve No. 1 and double acting cylinders to valves Nos. 2 and 3, it becomes necessary to fix the tractor lower links on the TO 35, MF 50, MF 202, and MF 65 tractors. The hydraulic shut-off valve on the MF 85 tractor must be "closed" when the tractor lower links are positioned below the full transport position.

NOTE: Refer to the Valve Operational chart on page 15 for the correct switch and by-pass valve settings for single and double acting cylinder applications.

VALVE BODY INTERNAL NOMENCLATURE

To further your understanding of the "Deluxe" auxiliary valve functions, this section of the manual is devoted to the valve internal component parts, valve body cast oil flow passages, and pressure ports.

VALVE INTERNAL PRESSURE AND SUMP PORTS

Three cast and machined ports have been incorporated into the valve body, as shown in Fig. 13. The main pressure port connects the valve to the tractor hydraulic pump and the second pressure port connects the valve to the tractor internal lift cylinder. The third port connects the valve to the tractor transmission case sump.

MAIN VALVE SPOOLS

The valve spools, which are located in the bored chamber in the lower portion of the valve body, as shown in Fig. 14, are of hardened steel material and chrome plated to resist wear and provide close tolerances with the valve chamber. The valve spools, when activated fore and aft in the valve chamber by the handle directs the flow of oil to the passages cast in the valve body.

SHUTTLE SPOOL VALVE

The shuttle spool valves, located in the bored chambers in the upper portion of the valve body, as shown in Fig. 14, are of highly polished high grade steel to minimize wear. The "shuttle valve" activates the check valve to permit oil to flow either to or from an external cylinder or opens an exit passage in the cast valve body for the pressured oil to return to the sump port, dependent upon the direction of the oil flow within the valve body cast passages.

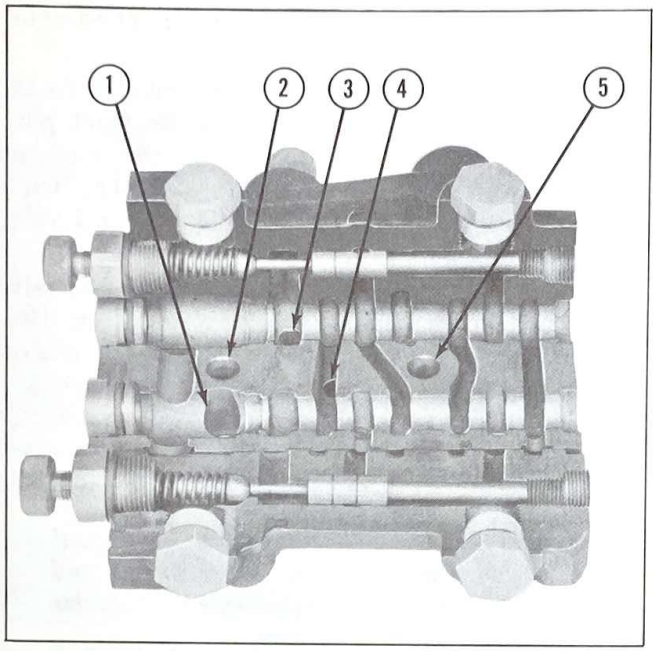


Fig. 13 Valve Internal Ports Nomenclature

1. Valve to Tractor Sump Port
2. Valve to Tractor Attachment Hole
3. Valve to Tractor Internal Lift Cylinder Port
4. Valve to Tractor Hydraulic Pump Port
5. Valve to Tractor Attachment Hole

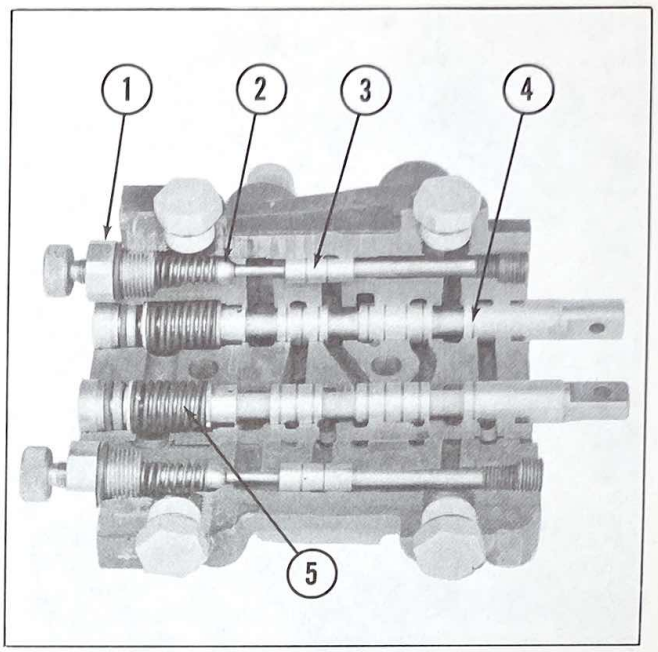


Fig. 14 Valve Internal Parts Nomenclature

1. Switch Valve
2. Check Valve
3. Shuttle Valve
4. Main Valve Spool
5. Valve Spool Regulator

CHECK VALVE

The check valves, located in the rear of the bored chambers in the upper portion of the valve body, as shown in Fig. 14, consists of a poppet valve and a poppet valve spring. The poppet valve, activated by either pressure or engagement with the shuttle spool valves allows oil to flow to and from an external cylinder, dependent upon the oil flow direction within the valve body cast passages. The check valve also prevents oil in the external hydraulic cylinder from returning to the valve body when the main valve spools are in neutral.

MAIN VALVE SPOOL REGULATOR

The main valve spool regulator, attached to the rear of the valve spool, as shown in Fig. 14, consists of a sleeve, spool retainer spring, spool collar, and a snap ring. The regulator returns the valve spool to neutral automatically from the detent lift or lower position when a preset pressure is reached. This automatic return is controlled by a spring and ball regulator located in a horizontal drilled hole in the rear end of the main valve spool.

VALVE OPERATING INFORMATION

The Massey-Ferguson "double or triple spool" external auxiliary hydraulic control valve will fulfill all of the requirements for operating single and double acting external cylinders and a multiple of useful tractor internal hydraulic system and external cylinder combinations.

Your tractor owners manual will serve as a comprehensive guide in acquainting you with the operation of the Ferguson tractor system. In this instance, therefore, the description is concerned primarily with the spool valve and connecting external cylinders.

To further your understanding of the valves operation, this section of the manual is devoted exclusively to the auxiliary valve functioning and oil flow circuits.

NOTE: It must be remembered that in order to have the auxiliary valve and connected cylinders react as desired, the cylinders must be correctly connected to the valve and the proper valve adjustments made, as described in the previous sections of the manual.

VALVE NEUTRAL OIL FLOW CIRCUIT

The open center control characteristic of the valve permits oil from the tractor hydraulic pump to enter the valve and return directly to the tractor transmission sump when all of the valve spools are in the neutral position. This condition will only exist when the tractor hydraulic pump control valve is in the "intake" position.

Therefore it is important to remember to place both the tractor draft control and hydralever in the fully raised position when operating the auxiliary valve.

When the main valve spools are in the neutral position, oil from the tractor hydraulic pump will enter the valve body and be directed by the valve

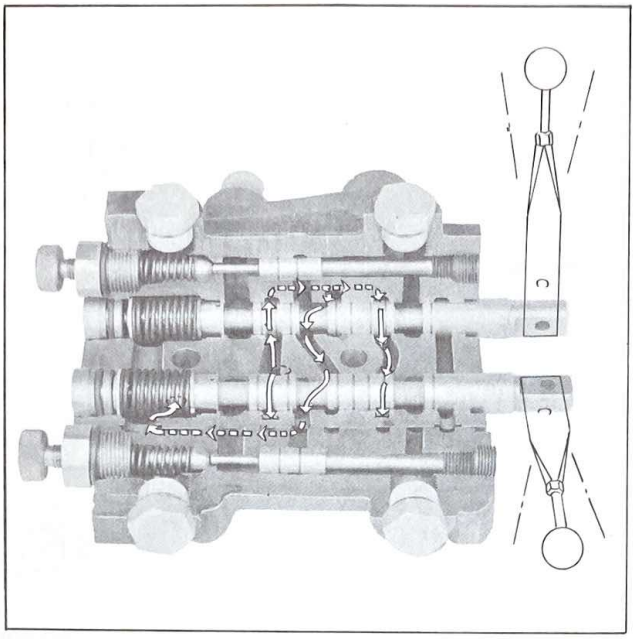


Fig. 15 Valve Neutral Oil Flow Circuit

spool through the cast passages to the sump port in the body, as shown in Fig. 15.

TRACTOR INTERNAL DRAFT CONTROL WITH VALVE ATTACHED OIL FLOW CIRCUIT

To operate the tractor internal hydraulic system with the auxiliary valve attached, all of the valve ports must be "plugged". Place the valve spool No. 1 in the detent lift position.

> *NOTE: The No. 1 valve spool may be locked in the detent lift position when prolonged tractor internal draft control use is anticipated on the TO 35, MF 50, and MF 65 tractors. Do not use valve Nos. 2 and 3 for this application. Refer to the Valve Operations chart on page 15 for the correct switch and bypass valve settings to use for this application.*

When the correct valve settings have been made, raising of the tractor hydralever causes the hydraulic pump to force oil under pressure into the auxiliary valve body. This oil is then directed by the No. 1 spool valve as shown in Fig. 16, through the internal cylinder port of the valve body to the tractor lift cylinder.

Once the hydraulic pump control valve reaches neutral, and pumping ceases the oil will be retained in the lift cylinder by the control valving in the internal system.

When the tractor hydralever is lowered oil is discharged from the hydraulic pump control valve discharge port by the force applied to the lower links. The flow of oil from the lift cylinder passes directly from the internal cylinder port to the pressure port through the body as shown in Fig. 16 to the stand-

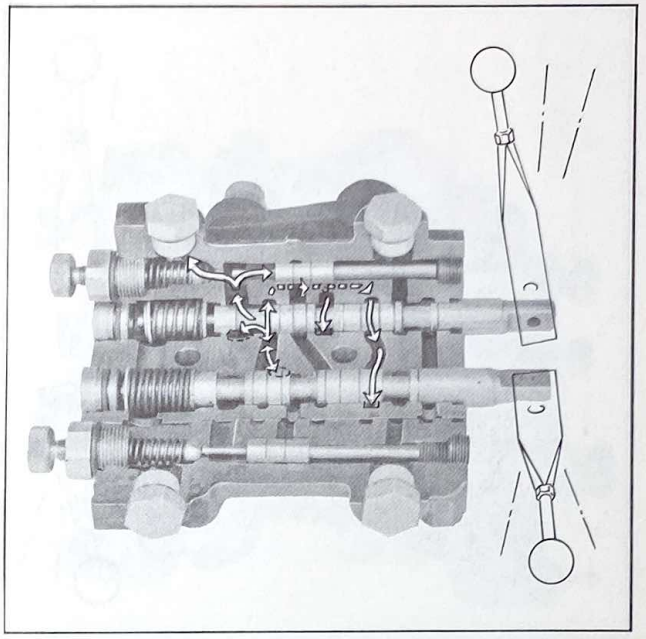


Fig. 16 Tractor Internal Draft Control Oil Flow Circuit with Valve Attached

pipe for discharge by the hydraulic pump control valve.

> *NOTE: With the auxiliary valve installed and correctly adjusted, the tractor internal hydraulic system functions are unchanged. Refer to the Tractor Owners manual for the operation of the tractor hydraulic system.*

SINGLE ACTING CYLINDER OIL FLOW CIRCUIT

To operate the auxiliary valve to control single acting external cylinders, raise the tractor hydralever and draft control levers to the extreme position.

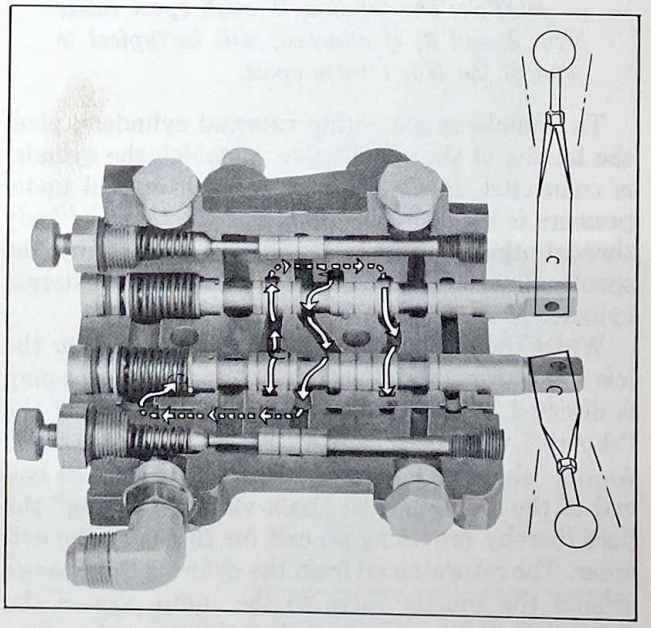


Fig. 17 Single Acting Cylinder Neutral Position, Oil Flow Circuit

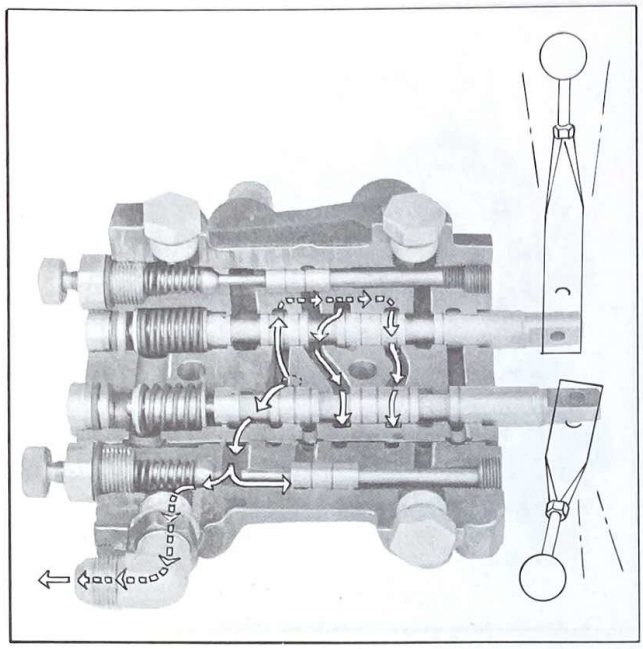


Fig. 18 Single Acting Cylinder Raise Position, Oil Flow Circuit

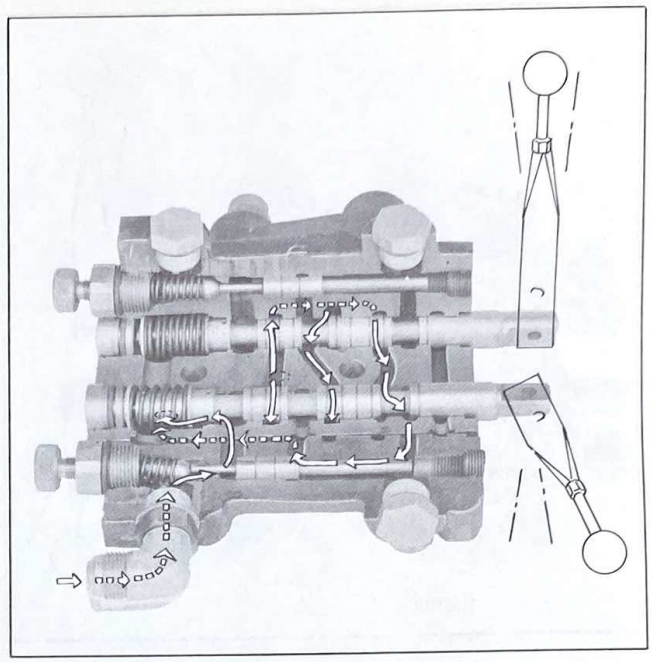


Fig. 19 Single Acting Cylinder Lower Position, Oil Flow Circuit

NOTE: Refer to the Valve Operations chart on page 15 for the correct valve ports, switch and by-pass valves settings to use for this application.

When the spool valves are in the neutral position, oil under pressure from the tractor hydraulic pump enters the valve body through the pressure port and is directed by the spool valves to the sump port in the body through the side cover assembly on the two spool valve or through a cast passage in the single spool valve, as illustrated in Fig. 17.

NOTE: The oil flow through spool valves No. 2 and 3, if attached, will be typical to that of the No. 1 valve spool.

To actuate single acting external cylinders, place the handle of the spool valve, to which the cylinder is connected, in the back (lift) position. Oil under pressure is then forced into the auxiliary valve body through the pressure port and is directed by the spool valve through the check valve to the external cylinder as shown in Fig. 18.

When the valve handle is placed forward to the lower position, oil pressure from the hydraulic pump is directed by the spool valve to the rod end of the "shuttle" valve moving it rearward in the chamber. As the "shuttle" moves rearward it engages the ball end of the spring loaded check valve, "opening" the port thereby providing an exit for the oil in the cylinder. The returning oil from the cylinder then passes around the shuttle valve to the sump port in the valve body to the sump as shown in Fig. 19.

In addition to actuating the check valve for cylinder oil "return" the shuttle valve is moved into position so that the oil pressure behind the valve is directed through another passage in the valve body through the side cover assembly on the two spool valve or cast passage in the single spool valve, to the sump port, as shown in Fig. 19. The "shuttle valve" will remain in this position until the valve handle is returned to the neutral position.

NOTE: If a third valve spool were attached to the valve body, or more than one single acting external cylinder connected to the valve body, the oil flow through the other valves is typical to that of valve No. 1 when the respective lift or lowering operations are performed.

SINGLE ACTING CYLINDER "FLOAT" POSITION OIL FLOW CIRCUIT

When a single acting external cylinder "float" condition is desired for unrestricted cylinder operations, such as gage wheel controlled tool bars, the valve spool handle must be latched in the lowered or forward position. In this position, oil from the hydraulic pump enters the valve body through the pressure port and is directed by the valve spools to the rear end of the shuttle valve, moving the valve rearward in the chamber where it engages the ball end of the spring loaded check valve, opening the port to the external cylinder. The returning oil from the cylinder passes through the shuttle valve to the sump port in the valve body, as shown in Fig. 20.

Movement of the "shuttle" valve rearward in the chamber uncovers a passage in the valve body through which the oil flows to the valve body sump

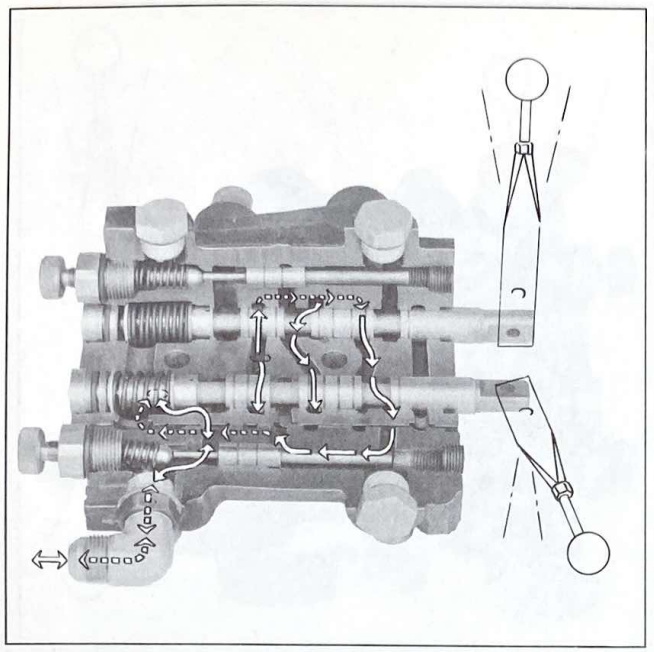


Fig. 20 Single Acting Cylinder Float Position, Oil Flow Circuit

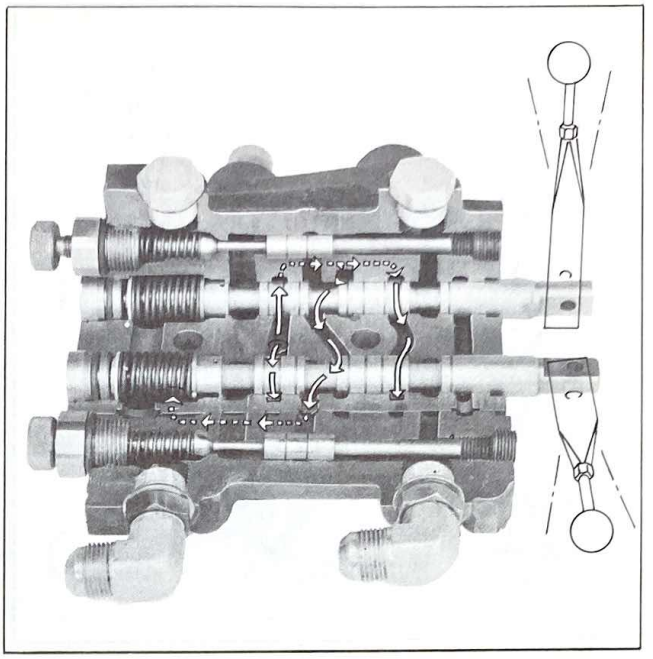


Fig. 21 Double Acting Cylinder Neutral Position, Oil Flow Circuit

port through the side cover assembly on the two spool valve or a cast passage in the single spool valve, as shown in Fig. 20.

With the valve spools latched in the forward or lowered position during operation, an unrestricted oil flow circuit from the cylinder is provided to the tractor sump; consequently, the cylinder is free to "float".

NOTE: It is impossible to lift an external cylinder or the tractor three point linkage when another valve is in the float position. Return all valves to the neutral position before attempting to raise an implement.

DOUBLE ACTING CYLINDER OIL FLOW CIRCUITS

To operate the auxiliary valve to control double acting external cylinders, raise the tractor hydra-lever and draft control lever to the extreme position.

NOTE: Refer to the Valve Operations chart on page 15 for the correct valve ports, switch, and by-pass valve settings to use for this application.

When the valve spools are in the neutral position, oil under pressure from the hydraulic pump enters the valve body through the pressure port and is directed by the valve spools through the side cover assembly on the two spool valve or a cast passage in the single spool valve to the sump port in the valve, as shown in Fig. 21.

To actuate a double acting cylinder, place the handle of the valve spool, to which the cylinder is connected, in the back or lift position. Oil under pressure from the hydraulic pump enters the valve body through the pressure port and is directed by the valve spool to the "shuttle valve" chamber. In the shuttle valve chamber, the oil pressure is divided between the force on the "head" of the shuttle valve and the check valve ball end. The "shuttle valve" is restricted from movement by the plug in the end of the chamber; consequently, the oil flows around the check valve to the cylinder, as shown in Fig. 22. As the cylinder piston is moved by the oil pressure exerted on it, it forces oil from the other end of the cylinder back into the valve body where it is directed

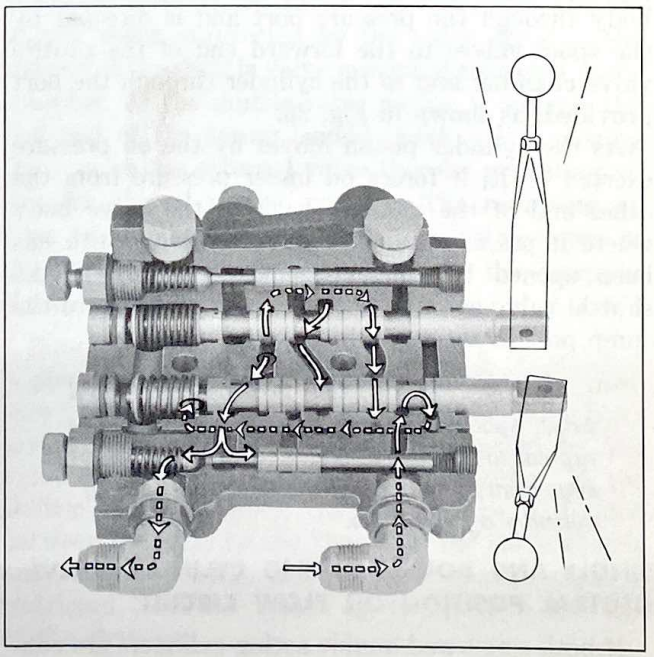


Fig. 22 Double Acting Cylinder Raise Position, Oil Flow Circuit

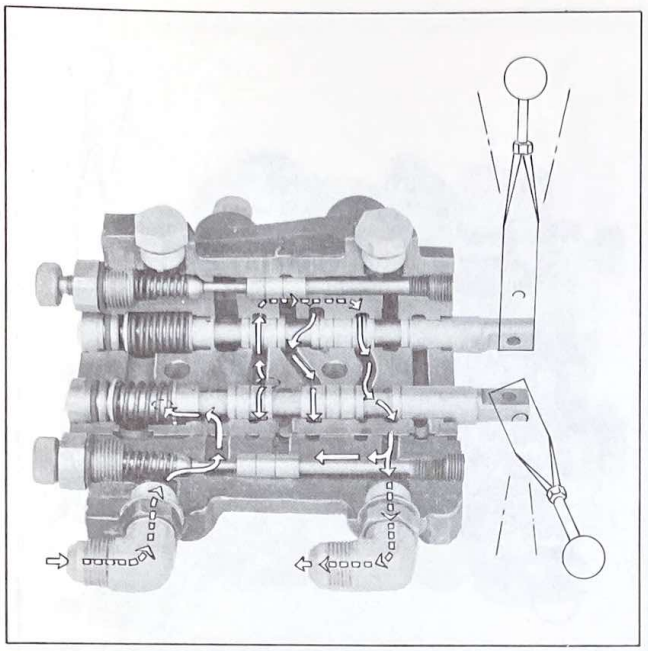


Fig. 23 Double Acting Cylinder Lower Position, Oil Flow Circuit

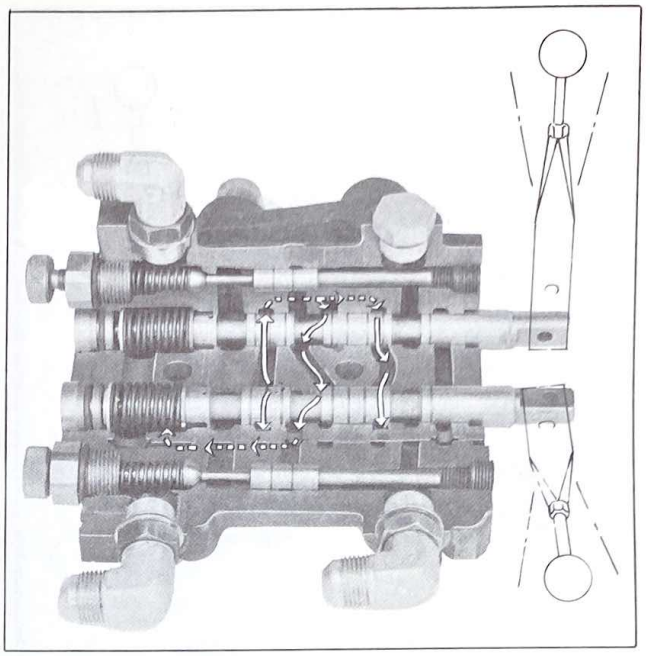


Fig. 24 Single and Double Acting Cylinder Neutral Position, Oil Flow Circuit

by the valve spool through the side cover assembly on the two spool valve or a cast passage in the third spool valve to the sump port in the valve body.

NOTE: The oil flow through the No. 3 valve spool chamber if attached, will be typical to that of the No. 2 valve spool in the raise position when used for double acting cylinder applications.

When the valve spool handle is lowered, oil under pressure from the hydraulic pump enters the valve body through the pressure port and is directed by the spool valves to the forward end of the shuttle valve chamber and to the cylinder through the port provided, as shown in Fig. 23.

As the cylinder piston moves by the oil pressure exerted on it, it forces oil under pressure from the other end of the cylinder back to the valve body where it passes around the check valve, which has been opened by the engagement pressure of the shuttle valve against it, and regulating valve to the sump port in the valve body.

NOTE: The oil flow through the No. 3 valve spool chamber, if attached, will be typical to that of the No. 1 valve in the lowering position when used for double acting cylinder applications.

SINGLE AND DOUBLE ACTING CYLINDER VALVE NEUTRAL POSITION OIL FLOW CIRCUIT

If both single and double acting cylinders are connected to the valve, and the valve spools are in the neutral position, the oil flow circuit through the valve is as follows. Oil under pressure enters the valve through the pressure port and is directed by the spool valves through the side cover assembly on the two spool valve or a cast passage in the third spool valve to the sump port in the valve body, as shown in Fig. 24.

SINGLE AND DOUBLE ACTING CYLINDER RAISE OIL FLOW CIRCUIT

When it is desired to raise both the single and double acting cylinders simultaneously, place both handles in the up or raised position. Oil under pressure from the hydraulic pump is directed by the valve spool, to which the single acting cylinder is connected through the check valve to the external cylinder, as shown in Fig. 25.

Simultaneously, when the double acting cylinder valve spool is placed in the raise position, oil under pressure from the hydraulic pump is directed by the valve spool to the "shuttle valve" chamber. In the shuttle valve chamber, the oil pressure is divided between the force on the "head" end of the shuttle valve and the check valve ball end. The shuttle valve is restricted from movement by the plug in the end of the chamber; consequently, the oil flows around the check valve to the cylinder, as shown in Fig. 25. As the cylinder piston moves by the oil pressure exerted on it, it forces oil from the other end of the cylinder back into the valve body. The returning oil in the valve body passes through the side cover assembly on the two spool valve or a cast passage in the third spool valve to the sump port in the valve body, as shown in Fig. 25.

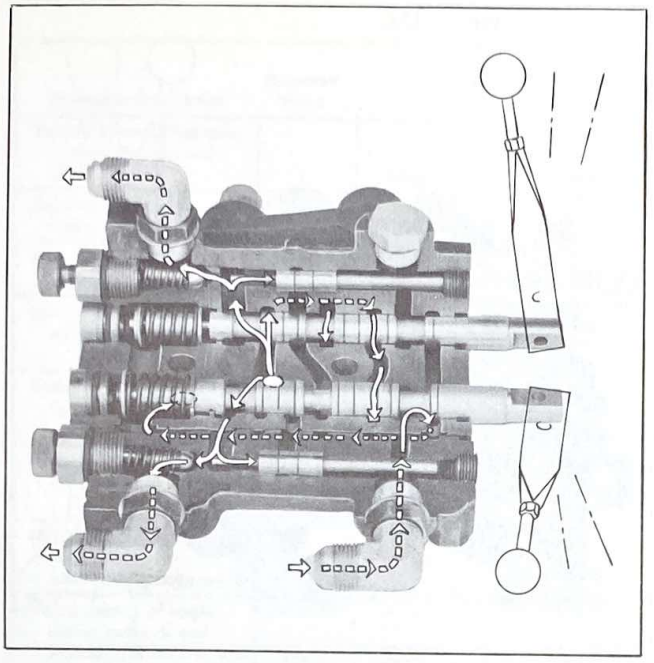


Fig. 25 Single and Double Acting Cylinder Simultaneous Raise Position, Oil Flow Circuit

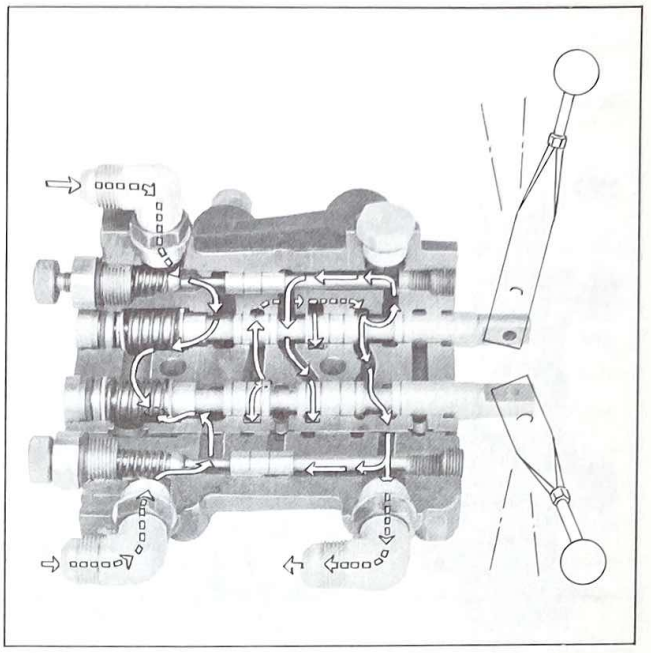


Fig. 26 Single and Double Acting Cylinder Simultaneous Lower Position, Oil Flow Circuit

SINGLE AND DOUBLE ACTING CYLINDER LOWER OIL FLOW CIRCUIT

When it is desired to lower both the single and double acting cylinders simultaneously, place the handles in the down or lower position. Oil under pressure from the hydraulic pump is directed by the valve spool to which the single acting cylinder is connected, to the "rod" end of the shuttle valve moving it rearward in the chamber. As the shuttle valve moves it engages the ball end of the spring loaded check valve, opening the port to the external single acting cylinder providing an exit for the oil in the cylinder. The returning oil then passes around the shuttle valve to the sump port in the valve body. In addition to actuating the check valve for cylinder oil "dumping", the shuttle valve moves into a position in the chamber so that the oil is directed through another passage in the valve body. Subsequently the flow from this passage is controlled by the No. 2 spool valve. Thus the flow is directed to the double acting cylinder, as shown in Fig. 26.

When the valve spool handle of the double acting valve is lowered, oil discharged from the No. 1 valve is controlled by the No. 2 spool valve and directed to the rod end of the No. 2 shuttle valve. After unseating the check valve for the return oil, the flow is directed to the opposite end of the double acting cylinder. The discharged oil then returns to the sump as shown in Fig. 26.

SINGLE ACTING CYLINDER LOWER DOUBLE ACTING CYLINDER RAISE OIL FLOW CIRCUIT

To lower the single acting cylinder and raise the double acting cylinder simultaneously the single acting valve spool handle should be placed forward and the double acting valve spool handle in the back (lift) position.

When the single acting cylinder spool valve handle is moved forward, oil under pressure from the hydraulic pump is directed by the valve spool to the rod end of the shuttle valve moving it rearward in the chamber. As the shuttle valve moves, it engages the ball end of the spring loaded check valve opening the port to the external valve thereby providing an exit for the oil in the cylinder. The returning oil then passes through the spool regulating valve to the sump port in the valve body to the sump, as shown in Fig. 27

Simultaneously, as the double acting spool valve is placed in the back or lift position, oil under pressure from the hydraulic pump enters the valve body through the pressure port and is directed by the valve spool to the "shuttle valve" chamber. In the shuttle valve chamber, the oil pressure is divided between the force on the "head" of the valve shuttle and the check valve ball end. The shuttle valve is restricted from movement by the plug in the end of the chamber.

Consequently, the oil flows around the check valve to the cylinder, as shown in Fig. 27. As the cylinder

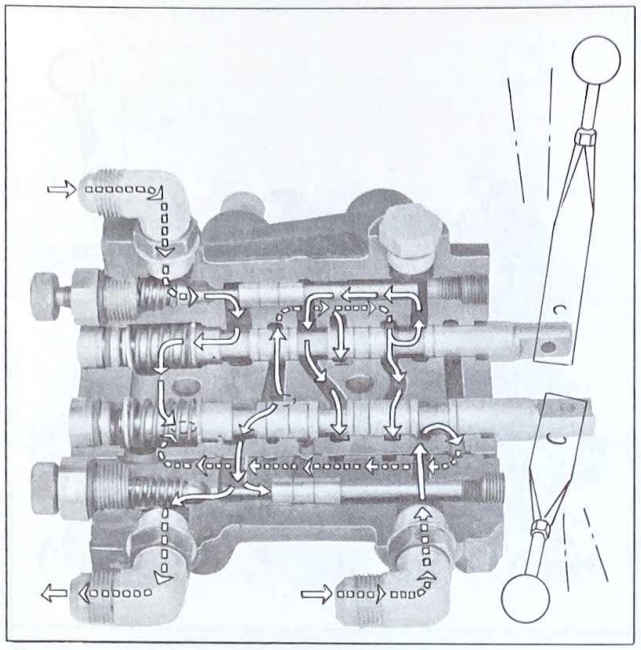


Fig. 27 Single Acting Cylinder Lower and Double Acting Cylinder Raise, Oil Flow Circuit

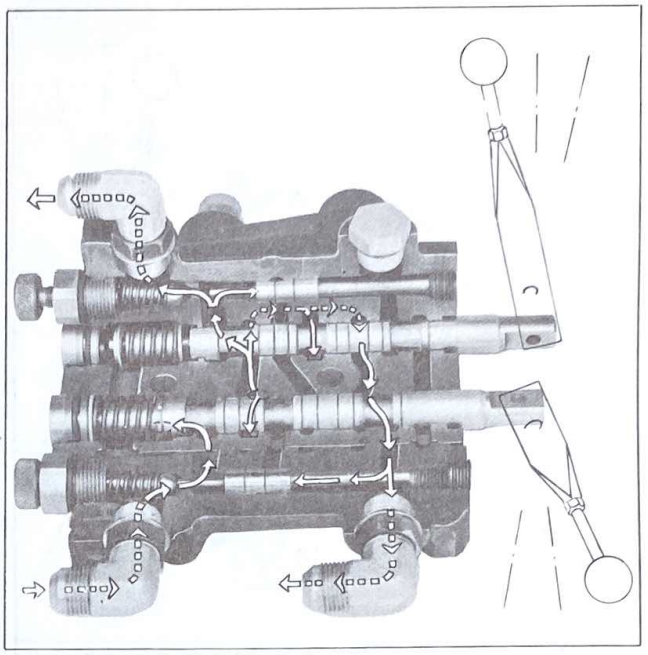


Fig. 28 Single Acting Cylinder Raise and Double Acting Cylinder Lower, Oil Flow Circuit

piston moves by the oil pressure exerted on it, it forces oil from the other end of the cylinder back into the valve body where it is directed by the valve spool through the side cover assembly on the two spool valve or a cast passage in the third spool valve to the sump port in the valve body, as shown in Fig. 27.

EXTERNAL SINGLE ACTING CYLINDER RAISE EXTERNAL DOUBLE ACTING CYLINDER LOWER OIL FLOW CIRCUIT

To raise the single acting cylinder and lower the double acting cylinder simultaneously, the single acting valve spool handle should be placed in the raise (back) position and the double acting valve spool handle in the lower (down) position.

When the single acting spool valve is placed in the back or lift position, oil under pressure from the hydraulic pump enters the valve body through the pressure port and is directed around the valve spool through the check valve to the external cylinder as shown in Fig. 28.

Simultaneously, when the double acting valve spool is placed in the lower (down) position, oil under pressure from the hydraulic pump enters the valve body through the pressure port and is directed by the No. 2 valve spool to the rod end of the No. 2 shuttle valve. After unseating the check valve, for the return oil, the flow is directed to the opposite end of the double acting cylinder. The discharged oil then returns to the tractor sump, as shown in Fig. 28.

NOTE: The oil flow through the valve spool No. 3 when attached will be typical to that of valve No. 2 in the respective operating positions.

CAUTION: Effective simultaneous raising and lowering is not possible when the last valve (to the right) in the circuit has the switch valve set in the single acting cylinder position and the valve handle in the lower position. For double acting cylinder use, it is possible to limit the maximum down pressure by adjusting the respective switch valve to throttle the oil flow.

MF 85 TRACTOR DRAFT AND VALVE CONTROL APPLICATIONS

It is possible with the open center auxiliary valve to operate the tractor internal draft control mechanism and open center auxiliary valve controls alternately on the MF 85 tractor.

NOTE: Refer to the Valve Operations chart on page 15 for the correct valve ports, switch, and by-pass valve settings to use for combinations draft and open center control applications.

After raising the implement from draft control applications with the tractor hydralever, set the hydralever to the "auxiliary pumping" position. The auxiliary valve can then be used for open center applications as described earlier in the manual.

AUXILIARY VALVE OPERATIONS CHART

Operation Description	Actuated Valve	Parts Used Valve No. 1	2	3	Switch Valve Position 1	2	3	By-Pass Valve Position	Lower Links Position TO-35	MF-50	MF-65	MF-202
Tractor Internal Hydraulic System Position and Draft Control	1	plug	plug	plug	out	out	out	In	free	free	free	free
External single acting cylinder (one)	2	plug	rear		out	out	out	In	free	free	free	free
External single acting cylinders (2 or more)	1-2-3	rear	rear	rear	out	out	out	In	fixed	fixed	fixed	fixed
External single acting cylinder float position (one)	2	plug	rear	plug	out	out	out	In	free	free	free	free
External double acting cylinder (one)	2	plug	front & rear	plug	out	in	out	In	free	free	free	free
External double acting cylinder (2 or more)	1-2-3	front & rear	front & rear	front & rear	in	in	in	In	fixed	fixed	fixed	fixed
MF-85 Tractor Internal Hydraulic System Position and Draft Control	1	plug	plug	plug	out	out	out	In	Open hydraulic lift shut-off valve			
Valve control of single acting external and tractor hydraulic lift cylinders for selective lift	1-2-3	plug	rear	rear	out	out	out	In	free	free	free	free
Valve control of single acting external and tractor hydraulic lift cylinders for delayed lift	1 & 2	plug	rear	plug	out	out	out	In	free	free	free	free
Valve control of double acting external and tractor hydraulic lift cylinders for selective lift	1-2-3	plug	front & rear	front & rear	out	in	in	In	free	free	free	free
Valve control of double acting external and tractor hydraulic lift cylinders for delayed lift	1 & 2	plug	front & rear	plug	out	in	out	In	free	free	free	free

SELECTIVE AND DELAYED LIFT CYLINDER APPLICATIONS

The valve spools, within the valve body, are so positioned as to provide a parallel open center pumping circuit for either simultaneous, selective, or delayed lift applications.

If the auxiliary valve switch and by-pass valves settings are correct and the cylinders connected to the correct valve spool ports as described for the particular application desired, the valve will meet your greatest expectations. Although the valve is most efficient and reliable, a certain amount of "know how", interest, care, and operating skill will be required to obtain the best external cylinder control for selective and delayed lift applications. The auxiliary valve manipulation skill will come quickly through familiarity.

TRACTOR ACCESSORY REMOTE CYLINDER KIT

To facilitate external cylinder implement control, there is available from your Massey-Ferguson Dealer two remote hydraulic control cylinder kits. Both kits can be installed to your tractor hydraulic system through the new "deluxe" two or three spool, single or double acting control valve.

The single acting cylinder kit, as shown in Fig. 29, is an A.S.A.E. standard, 2 inch diameter cylinder with an 8 inch stroke. The double acting cylinder, as

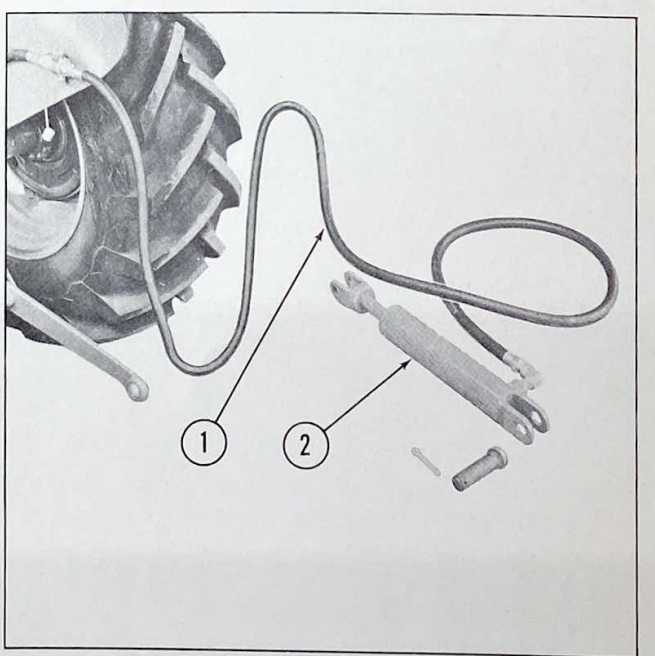


Fig. 29 Single Acting Cylinder Assembly
1. Hose Assembly 2. Cylinder Assembly

shown in Fig. 30, is an A.S.A.E. standard 2½ inch diameter cylinder with an 8 inch stroke.

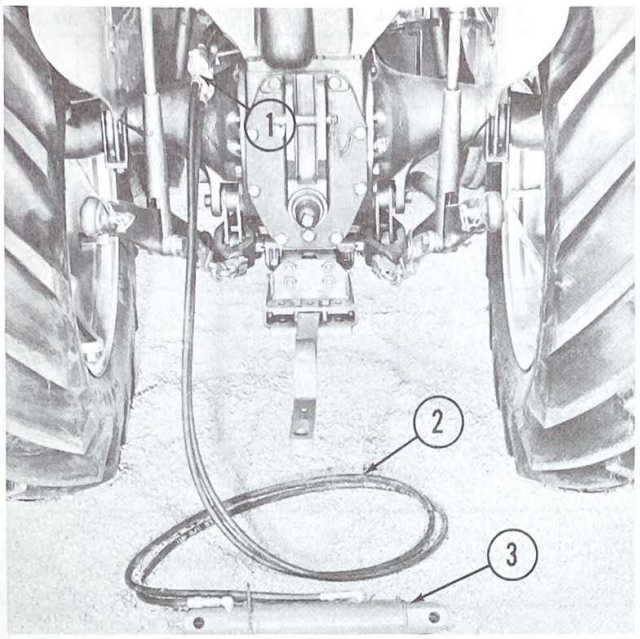


Fig. 30 Double Acting Cylinder Assembly
1. Hose Coupler 2. Hose Assembly
3. Cylinder Assembly

Either external cylinder can easily be installed to your tractor, as shown in Fig. 31.

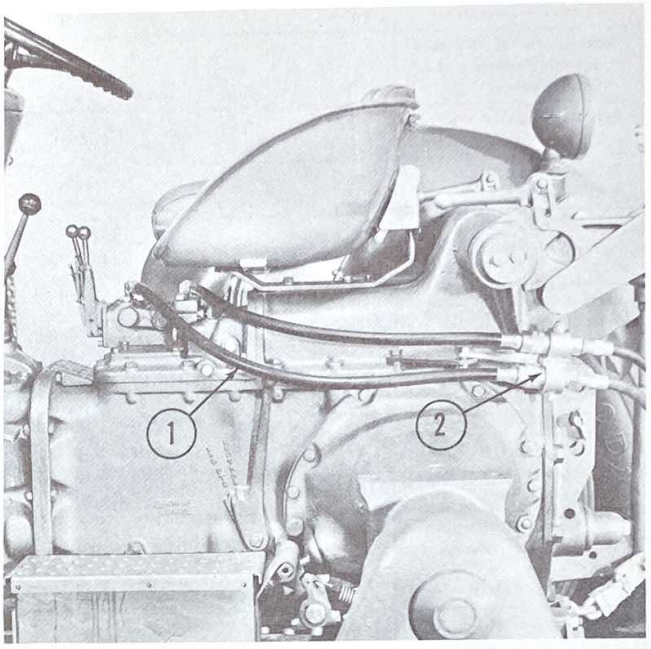


Fig 31 MF 85 Tractor Remote Cylinder Control Kit Attached to the Valve
1. Hose Assembly 2. Coupler Assembly

50M 12-58

LITHO IN U.S.A.